

OBSERVATIONS ON TERRITORIAL BEHAVIOR OF LEAST FLYCATCHERS

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ALTHOUGH the theory of territorialism has been amply studied and reviewed, a number of aspects remain to be clarified. This study of the Least Flycatcher (*Empidonax minimus*) attempts to use information obtained about the breeding sequence to understand certain aspects of the development of territorial behavior. The paper also discusses in some detail the clutch size, hatching and fledging success, and the incubation and feeding behavior for a dozen nests.

In particular, this study has emphasized the analysis of the role of the *chebec* call of the male. Although this call is generally accepted (MacQueen, 1950) as the "territorial song," the existence of an elaborate flight-song performance in the genus (see McCabe, 1951, for detailed description for Traill's Flycatcher [*E. traillii*]) presents problems in interpretation. For Hammond's Flycatcher (*E. hammondii*) Davis (1954) suggested that the *chebec* note be called a patrol note and that it "serves to indicate to the female the position of the male." The present study pursues this problem.

The genus (*Empidonax*) has attracted attention from a number of persons. Bent (1942:174-260) assembled miscellaneous notes on the various species. McCabe (1951) observed the flight song of Traill's (Alder) Flycatcher and found that the birds simultaneously performed in the evening an elaborate song which was timed in relation to sunset, and persisted till August 8. MacQueen (1950) described the territories and song of the Least Flycatcher at the University of Michigan Biological Station for three summers. The details of her work will be discussed under each section below. Davis (1954) described the breeding of Hammond's Flycatcher at the Montana State University Biological Station at Flathead Lake for three summers and compared several aspects of six species in the genus.

The current report presents the results of observations at the University of Virginia Biological Station at Mountain Lake, Virginia, from June 13 to July 18, 1956. Unfortunately, the birds had already started nesting and thus the inception of breeding was missed. The procedures were essentially to map territories, record behavior in building the nests, determine frequency of attentive and feeding behavior, and count the number of *chebec* calls. Observations were started at dawn every day from June 14 to July 16. The individual birds were not marked by bands or other devices because it was felt that the birds might desert the nest or area, and because such marks would be very difficult to see in any case.

The problem of obtaining statistically adequate data for Least Flycatchers

arises, as it did for Hammond's Flycatcher. Although about 125 hours of actual observation time were accumulated, when divided among 10 pairs, several periods of the day, and various phases of the nesting cycle, there are only a few observations in each category and thus no useful measure of variability is available for statistical comparison of categories. Thus statistical significance cannot be determined. The result is a description of what was recorded rather than attempts at generalizations concerning the breeding of Least Flycatchers as a species. While the study is therefore deficient in this important aspect, it is considered worthwhile to report the observations because it seems unlikely that a sample of suitable size (perhaps 6000 hours!) will soon be obtained, and also because these observations may suggest generalizations.

The Biological Station is located near Mountain Lake, Virginia, about 50 miles west of Roanoke. It is on Salt Pond Mountain at an altitude of 3800 feet. The forest is basically oak-chestnut (Braun, 1950:232), although the chestnuts have been killed by blight. In addition to white oak (*Quercus alba*), which may comprise 50 per cent of the trees, red oak (*Quercus borealis*), cucumber tree (*Magnolia acuminata*), pitch pine (*Pinus rigida*), and sweet birch (*Betula lenta*) are the most important species. The grounds of the Biological Station have been cleared and present a park-like appearance (Fig. 1). The flycatchers inhabited this area as well as more dense adjacent areas. Large tracts of apparently suitable dense vegetation lacked flycatchers. Perhaps the Least Flycatchers that lived in the dense vegetation can be considered as overflow from the open area (Fig. 1), and thus do not contradict Breckenridge's report (1956) that these flycatchers are scarce in dense vegetation.

The birds formed a definite colony in the study area. Searches in nearby areas revealed no birds, even in apparently suitable vegetation. Actually there were two parts to the colony. The area of the Station grounds (Part 1) consisted of about 19 acres, and contained nine nests and two pairs that failed to nest. The flycatcher density thus was 22/19, or 1.2 birds per acre. The other area (Part 2) adjoined the Station on the south and bordered the road to Mountain Lake. It consisted of about 9.5 acres. Observations in this area were not as intensive. During the time available only one nest and one fledged brood were found although two other pairs may have been present. On this basis the density was 8/9.5, or 0.8 bird per acre.

Colonial distribution has been recorded by a number of observers (Bent, 1942; Kendeigh, 1947:48; MacQueen, 1950). The latter recorded densities of 2.0 to 2.7 pairs per acre, which is much higher than the density here recorded.

The other birds present included (in decreasing order of abundance) Robins

(*Turdus migratorius*), which built at least 15 nests on the grounds; Cedar Waxwings (*Bombycilla cedrorum*), which nested commonly; Rufous-sided Towhees (*Pipilo erythrophthalmus*); Eastern Wood Pewees (*Contopus virens*); Yellow-shafted Flickers (*Colaptes auratus*); Rose-breasted Grosbeaks (*Pheucticus ludovicianus*); Eastern Phoebes (*Sayornis phoebe*); and Chestnut-sided Warblers (*Dendroica pensylvanica*) on the borders.

A preliminary remark about identification of sex is necessary. Since the plumage is identical, sex was determined by the *chebec* call. The claim that only the male makes this call is based on the fact that both birds of a pair never gave the *chebec*; the bird that built the nest and incubated never gave it. Although no birds were collected here, collections of Hammond's Flycatcher (Davis, 1954) always verified the belief that only the male called.



FIG. 1. The nesting area of Least Flycatchers, showing the park-like habitat.

VOCALIZATIONS

The Least Flycatcher has a variety of notes that serve various functions. The notes and their presumed function will be described below and then the suggestions of other authors will be discussed.

Male Position Note.—This is the familiar *chebec* note, which is generally

considered to be the territorial song. The note is sharp and harsh and the first syllable is about five scale tones above the second. The frequency during the day and during the nesting cycle is given in Table 1. The data are grouped into time periods that are somewhat arbitrary, but are based on obvious changes in frequency and on the number of observations available. The stages of breeding are divided into two intervals for laying (assuming that 4 eggs were laid) and three five-day intervals for incubation and feeding. The day incubation began is called zero. It is, of course, obvious that such arbitrary divisions are somewhat unsatisfactory in the examination of continuous trends, but some decision was necessary for analysis. Table 1 gives simply the total minutes of observation for each category and the rate of calling *chebec* per 15 minutes. Thus in the first cell (0430–0530 for stage –4–3 days), during 97 minutes of observation, the birds gave *chebec* calls at an average rate of 359 per 15 minutes. The value was obtained by averaging the rate for each bird rather than dividing the total calls given by all birds by the total minutes of observations. For example, the first cell (0430–0530 for –4–3 days) comes from four observations varying from 12–42 minutes long and having rates varying from 62 to 775 per 15 minutes.

The table shows that in these observations the number of *chebec*'s declined markedly during the day. Also, the number of calls from 0430–0530 declined during the breeding cycle after the first stage. The calls after 0530 showed no striking change during the cycle. The increase from days –4 and –3 to days –2 and –1 will be discussed under territory.

TABLE 1
FREQUENCY OF *CHEBEC* CALLS PER 15 MINUTES DURING DAY AND DURING NESTING CYCLE

Stage of breeding	Days	Time periods of day (EST)								Birds observed
		0430–0530		0530–1000		1000–1230		1300–2000		
		Min.	Per	Min.	Per	Min.	Per	Min.	Per	
Laying	–4–3	97	359	279	99	0	–	50	54	3
	–2–1	60	733	35	217	90	2	40	2	1
Incubating	0–4	91	595	777	160	15	281	230	73	2
	5–9	60	242	902	78	86	69	60	51	4
	10–14	116	150	864	121	0	–	107	0	3
Feeding	15–19	80	211	413	196	0	–	0	–	3
	20–24	135	118	614	100	185	12	270	4	4
	25–29	220	102	765	54	60	5	739	4	4

Min.—Total minutes of observation during this time period and stage.
Per—Average number of *chebec* calls per 15 minutes.

The decline in calls in the early morning is analyzed in more detail in Table 2. The frequencies are divided according to incubation and feeding, and a

decline between these stages is apparent in all the time periods. A slight increase of calls occurs in the very early morning and then a decline during the rest of the time. The decline is rather gradual for the group, but for any one bird may be abrupt on some days. However, no marked "rhythmic song" period was observed as reported by MacQueen (1950:201). Certainly no "end" could be assigned to the calling period except for some birds.

TABLE 2
FREQUENCY OF *CHEBEC* CALLS PER 15 MINUTES FROM 0430-0630

Stage	0430-0445		0445-0500		0500-0515		0515-0530		0530-0600		0600-0630	
	Min.	Per	Min.	Per	Min.	Per	Min.	Per	Min.	Per	Min.	Per
Incubating	25	605	62	788	100	220	85	266	367	161	299	97
Feeding	51	331	111	357	158	188	182	78	388	20	280	24

Min.—Total minutes of observation during this time period and stage.
Per—Average number of *chebec* calls per 15 minutes.

Other observations suggest that the frequency of *chebec* is less in the afternoon than in midmorning. Counts were made on Male 6 on five mornings between 0900-1000, and on seven afternoons between 1500-1600. The mean calls per hour was 13.5 for the morning and 3.36 for the afternoon.

The conclusion that the frequency was less for the feeding stage than for the incubating stage can be examined at Nest 1 where observations were made at the same times of day before and after hatching. In 24 half-hour periods before hatching the average was 100 (SD = 210), while after hatching the mean for 22 half-hour periods was 28 (SD = 47). $P < .01$. A change of this type might of course be due to a purely seasonal trend. To check this point counts on the same days of birds that are incubating and of others that are feeding are required. Such counts are available for only a few birds and are thus highly influenced by the individuality of the bird. However, the males in the incubation phase did call more frequently than the males in the feeding phase.

The male starts calling before sunrise. The starting time was obtained for one male on 10 mornings. It varied from 0424 to 0444. Sunrise during this time (June 17-July 3) was essentially at 0450 (EST). This bird appeared to start later on rainy mornings and later as the breeding cycle progressed.

There was so much individual variation among the males that some comments about each male seem justified. Male 1 was a persistent caller, who gave 52 per cent of his calls from two white oaks. He called regularly during the day after a rapid series early in the morning. He also called regularly when feeding the young and even after they had left the nest. Male 2 (nest with young when observations started) called rapidly early in the morning but only occasionally during the day. He called in early morning even when the

young had been out of the nest for 20 days. Male 3 was very quiet and called only rarely after 0500. In the feeding stage he called so rarely that the identification of sex was not possible at feeding. Male 4 called regularly and followed the average pattern until the nest was deserted, when he increased his calls to around 450 per 15 minutes. In fact, the sudden increase in calling during the entire day aroused suspicion and it was then found that the nest was deserted. The male remained for eight days but his calling decreased markedly after the fourth day. Male 5 was the most persistent caller of all the males. He called late in the day and frequently during feeding and even after the young had left the nest. Male 6 was an "average" caller. Male 7 (whose mate built and abandoned four nests) called very frequently and persistently after the first few days. His calls increased from 13 per 15 minutes on the first day of observation (female building) to 91 (female building second nest) to 927 (female building third), but declined to 560 (female building fourth). However, when the female disappeared he called at 960 per 15 minutes for several mornings and also very frequently during the day. He was last heard seven days after the female disappeared. Males 8 and 9 were observed only in the feeding phases. Both called regularly very early (0445-0500), after the young were out of the nest, at a high frequency (300-900 per 15 minutes) for about 10-15 minutes and then practically stopped for the day. Male 10 was first noticed on June 25 when the female laid her first egg of four. He was noticed because of his calls, but the rate was very low (32 per 15 minutes). It seems certain that the frequency had been even lower in the building phase because the bird had not been noticed although considerable time was spent at the adjacent nests. The calls increased to 855 on the day the last egg was laid and continued normally during incubation. Male 11 was a very frequent caller for several days. (The female was seen only once, at her empty nest on the day it was found.) He continued for several days after she disappeared. Male 13 nested late (female laid July 2) and called at a high rate during laying but soon stopped except for a short time very early in the morning.

Female Position Note.—A soft, mellow note is given by the female when building or off the nest. Phonetically it resembles *whit*. The note is not given from the nest or when the male arrives. It appears to have the same function as the *chebec* note of the male. Apparently this note is the one rendered as *chweep* by MacQueen (1950:203) rather than the one rendered by her as *whit*. Some counts of the female position note suggested that the frequency may increase at fledging.

Alarm Call.—The alarm call is given by both male and female and sounds like *tweep*. It is rather harsh and loud but the male note is slightly lower in pitch than that of the female. The note is given sometimes when a person comes near but characteristically when a cat, Blue Jay, or black snake appears. This must be the note rendered as *whit* by MacQueen because she says both sexes give it, even though she says her *chweep* was given in defense of the nest.

Flight Song.—A performance was observed on the evenings from June 16-25 at dusk. The typical development was that several males started calling *weep* (ascending in pitch at the end) sporadically and hopping upward in a tall tree. Then after more rapidly repeated *weep* notes, several birds would fly about 100 feet above the trees uttering an assortment of warbles, *weep*'s, and *chebec*'s. Then the bird would tumble and dive into the treetop, flying more

like a butterfly than like a bird. This song is obviously the flight song reported by various authors and described in detail for Traill's (Alder) Flycatcher by McCabe (1951). The performer is assumed to be a male because all gave *chebec* calls.

The performance occurred between 1950–2010 (sunset at 1912) on each evening observed. Birds in all stages of breeding performed. Observations were made every evening from June 16 to July 5, but the last flight song was observed on June 26. It was impossible simultaneously to observe every bird, and thus some performances were missed. However, it was possible to be in a position to watch and identify several at the same time. It is clear that the birds whose females were building or laying performed most constantly. To compare the frequencies according to the phase of the cycle the number of birds performing may be compared with the chances to observe a bird (which is the number of evenings multiplied by birds in the phase). Males in the building phase performed on 4 of 9 chances; males in the laying phase performed on 5 of 6; males in the incubating phase performed on 8 of 33; and in the feeding phase on 2 of 44. On the two evenings when no actual flight was made, several birds started the performance by calling *weep, weep* and ascending in the tree, but failed to fly up.

This performance was never observed in the early morning, although observations were started daily at 0415 when there was less light than at the time of the evening performance.

Greetings.—Both the male and female may chatter and twitter when they meet away from the nest or at the nest. Typically the greeting is given when the female comes off the nest during incubation or comes from the nest during feeding of the young.

Defense.—During the latter part of the observation time a number of strange birds wandered through the area. Presumably these birds had lost their nest or mate by some accident and were searching for a new place. The owners of the territory met these birds with a series of *weep-weep* notes, identical to the notes in the flight song, and drove the strangers away. This note is clearly an aggressive note. It was not possible to determine whether the female gave the note.

Building Note.—A *churr* was given by the male and female as she built the nest, but its function is not known. It was not heard after incubation began. The birds flutter their wings somewhat as they go from branch to branch.

Calls of Young.—During the last few days of feeding the young may produce some notes in the nest. However, as soon as the young leave the nest they emit a mellow chip note that apparently serves as a location note to help the adults find them. In one case a young bird gave this call when it was out on a branch near the nest but not after it hopped back into it.

TERRITORIAL BEHAVIOR

The territorial behavior of the Least Flycatcher very closely resembles the behavior of Hammond's Flycatcher (Davis, 1954) and other members of the genus: Dusky (*E. oberholseri*), Acadian (*E. virescens*), and Western (*E. difficilis*) (personal observations). The males defend the territory and the females defend a small area around the nest. After the young leave the nest both male and female drive other Least Flycatchers away from the territory even though the young may be outside.

The young generally leave the territory. Two broods left one day after hatching, three broods left two days after (but one of them returned to its territory 13 days later), one brood remained in its territory for 12 days, while another remained 13 days.

The size of the territory differs among pairs and according to the stage of breeding. Although it is difficult to define the boundaries precisely, in general the male has a territory ranging from 0.35 to 0.55 acre in size. The territories of four males in incubation or laying were 0.33, 0.35, 0.54 and 0.55 acre. Territories of three males during the feeding phase were 0.15, 0.26 and 0.37 acre. One male had a very large territory (2.8 acres), which was reduced to about 0.3 acre during feeding. It is perhaps significant that this bird had a neighbor on only one side of his territory. Another bird, which started nesting late (June 26), had a territory of 0.23 acre bounded on nearly 80 per cent of the periphery by other birds. The female may use part of the male's territory or have an area of her own to which the brood may go when leaving the nest.

The defense of the territory is performed by active fighting. The male defends a larger area than does the female. The function of the various notes in the defense of the territory is not clear. Presumably the flight song is territorial, although it is not performed during the daytime. An integral part of the flight song is the defense note described above as *weep-weep*. It was performed regularly by the male when driving out an intruder and actually fighting. On 24 occasions a fight between flycatchers was observed, and on 18 the defender used the call. In two other cases an invader used this call. On seven occasions *chebec*'s accompanied the fights but at no greater rate than usual. Twice after severe fights no *chebec*'s were given. The *weep* note was given at all stages of breeding, but was more common later, presumably because more strangers were around. While the above evidence suggests that the *weep* call is a means of territorial defense, some other evidence does not support this conclusion. On June 25 a pair took up a territory adjacent to another pair that was feeding young. Not until July 1 (second day of incubation) was the *weep-weep* call heard, although some fights between the males had been seen. However, the number of *chebec*'s was no greater than normal by either bird.

The observations cited above do not suggest that the *chebec* is a territorial song; they show that the *weep-weep* note is aggressive. However, some other observations agree with the interpretation that *chebec* is territorial. It is clearly given from a few particular perches that are conspicuous. It may be used in opposition to an adjoining male. The male stops calling *chebec* when he leaves his territory. But in contrast to this view is the fact that at both nests which were started after observations began, the *chebec* calls did not reach maximum frequency till the cycle was advanced. In one case the bird was not heard till the day the first egg was laid, even though observations were made in adjacent areas. In the other case the male did not reach the maximum until the sixth day of building (the female started four nests). When the female disappeared (two cases) the number of *chebec* calls increased from 50 to 376 per 15-minute interval. No female was obtained although several were wandering around. Neither of these behavior sequences fits the pattern of conventional territorial song behavior.

When fighting against other Least Flycatchers or other species the bird clicks its bill rapidly thus making a loud clatter. The Least Flycatcher was seen to drive Robins, vireos, White-breasted Nuthatches, Cedar Waxwings, Rufous-sided Towhees, warblers and Wood Pewees away from the nest and young. Yellow-shafted Flickers and Hairy Woodpeckers were watched but not attacked.

The patterns of fighting described above do not fit the "typical" (Song Sparrow, Indigo Bunting) territorial behavior. In particular the two types of song are peculiar. The current observations agree with the suggestion (Davis, 1954) that the notes (the *chebec* of the Least Flycatcher and Hammond's, and the corresponding notes of other species) serve to indicate to the female the position of the male. Similarly the female note (here called *whit*) indicates to the male the position of the female. The vigorous calling in early morning is not clearly explicable on this basis, but might be an extension of location notes needed in the darkness. It has long been accepted that the function of territorial song is to repel aggression and to advertise to the female that a male is present. Perhaps in these flycatchers these functions are each attached to different notes so that there exists aggressive song and advertising song (position note).

NESTING CYCLE

Nest.—The nest is built in a crotch of a small tree or fork of a large tree, or on a lateral limb. Of 14 nests observed, 4 were in a crotch of a white oak sapling (about four inches DBH) and 7 were on a horizontal branch of a large white oak, 2 were on branches of pitch pines and one was on a branch of a sugar maple sapling. The average height was 15.8 feet, distributed as follows: 7 feet, 1 nest; 11–12 feet, 4 nests; 13–14 feet, 4 nests; 15 feet, 2 nests; 27 feet, 1 nest; and 35 feet, 1 nest. One female started four different nests on horizontal branches of large white oaks, all 20–30 feet above the ground.

The nest is a compact bowl, constructed from plant fibers and lined with some feathers or fluffy plant material. The inside diameter is two inches. The nests were very similar irrespective of location. In only one case was building observed and it may have been abnormal. A female over a period of seven days started four nests. The first was demolished by waxwings and the others were abandoned. The male did not accompany the female on her trips to the nest but called nearby.

Eggs and Young.—Five nests when first observed had eggs. The average clutch was 3.4 and was distributed thus: 2 eggs, 1 nest; 3 eggs, 1 nest; 4 eggs, 3 nests. Three other nests had young when first observed: 4 young, 2 nests; 3 young and 1 unhatched egg, 1 nest. Assuming that none of these latter 3 clutches originally had 5 eggs, the mean clutch size was 3.6. Six nests were inaccessible or destroyed before the contents were observed.

One egg in one nest did not hatch and none of four eggs in a late nest hatched. Thus the proportion hatching was $24/29 = 83$ per cent. This result does not include a nest that was empty when found and was deserted the following day by the female.

Only one young failed to fledge. Thus the proportion was $23/24 = 96$ per cent for the seven nests for which data were obtained. The proportion of eggs that produced fledglings was $83/96 = 80$ per cent.

The duration of nestling period was obtained in four cases: one of 14 days, two of 15, and one of 16. The period was measured from the day the first young hatched to the day that one of the young left the nest. The time of departure was observed at seven nests. In five cases the young left before 1000. In one case the two young left about 1900, and in one case three left about 1900 and one left the following morning.

Independence may not be attained for about three weeks. One brood was still fed by the adults at 21 days although the young had been catching insects by themselves for five days. All the other broods left the area before the stage of independence was reached. No young were known to have died in the post-fledging period of dependency.

Incubation.—The incubation is performed by the female alone. This agrees with MacQueen (1950:198) but is contrary to Bent's opinion (1942:216) that "probably both sexes incubate." Quantitative data on incubation and brooding are presented in Table 3. The percentage of time on the nest is remarkably constant during the day and during the stages. The only outstanding value is for early morning 0-4-day stage, but this is merely sampling variability, for most of the data were obtained on one bird on the morning of the day incubation started. The average of the percentages in Table 3 (omitting 28.4 per cent) is 77.1 per cent which can be used as the percentage of time the female is on the nest.

TABLE 3
PERCENTAGE OF TIME SPENT INCUBATING OR BROODING

Stage	Days	Time of day					
		0430-0730		0830-1230		1330-2000	
		Min.	Per Cent	Min.	Per Cent	Min.	Per Cent
Incubation	0-4	244	28.4	207	75.5	236	81.5
	5-9	388	80.0	323	76.3	0	—
	10-14	384	82.0	397	73.2	529	78.2
Brooding	15-19	456	77.3	357	74.5	387	72.9

Min.—Total minutes of observation during this time period and stage.

The duration of incubation was not obtained for any clutch, but is assumed to be 14 days, although Bent (1942:216) states "the period of incubation is said to be 12 days." The assumption of 14 days is based on the meager evidence that incubation lasted at least 12 days in one nest and that Davis (1954) found a period of 15 days for one nest of Hammond's Flycatcher.

The male may feed the female while she incubates. At one nest he fed her 11 times in 360 minutes and at another nest 12 times in 128 minutes. The weather was cold and foggy on these days.

The eggs in most nests hatched over a period of two days but in one nest during three days. The female continues to brood for several days. She stays on the nest at night at first but when the young become large, she perches on the edge.

Feeding.—The male and female feed the young. During the early stages of feeding the male sometimes gave food to the brooding female who then gave it to the young. The sex of the bird could usually be determined by a difference in behavior, checked by the call notes. The male characteristically perched on a small twig to feed the young, whereas the female perched on the nest or in some cases on a different branch. The individual birds were very consistent in their approach. In one case the male changed perches in the last three days apparently because the size of the young made the former perch unsuitable. Some males called *chebec* regularly at feeding. Male 1 called 25 times for 99 feedings.

Table 4 gives the frequencies of feeding. The data are divided into stages of nestling development by 5-day periods and into three parts of the day. It is apparent that the total rate of feeding increases rapidly and more than doubles from early to late nestling stage.

TABLE 4
HOURLY FEEDING RATES BY TIME OF DAY

Stage of nesting	Time of day					
	0430-0730		0830-1230		1330-2000	
	Min.	Rate	Min.	Rate	Min.	Rate
15-19 days	315	4.8	411	7.5	743	4.8
20-24 days	570	14.0	622	10.6	1029	11.7
25-29 days	727	16.2	701	13.6	1039	14.6

Min.—Total minutes of observation during this time period and stage.

The number of young also affects the feeding rate. One nest had two nestlings and the other nests all had four nestlings. The average rate per hour was 7.2 in the nest with two young, and 14.2 in the other nests. These figures include all observations and the distribution by time of day and stage of feeding is comparable.

Table 5 gives the percentages of feedings by the male. The sex was identified in 65.6 per cent of 1280 feedings. No trend in proportion of feedings by the male is apparent either by stage of nesting or time of day.

The fecal sac was removed by males and females. Within a pair, however, considerable difference in frequency appeared to occur.

When the young are 12-13 days old they begin to flap and stretch their wings. In another day they may stand on the rim of the nest and flap their wings very rapidly. On about the 15-16th day they may leave the nest. A bird may hop out to a branch and then come back in. When they leave, they can fly a yard or more. They generally hop gradu-

TABLE 5
PERCENTAGE OF FEEDINGS BY MALE

Stage of nesting	Time of day					
	0430-0730		0830-1230		1330-2000	
	Feedings	Per Cent	Feedings	Per Cent	Feedings	Per Cent
15-19 days	22	40.8	50	68.0	38	42.1
20-24 days	91	66.8	55	52.7	110	55.5
25-29 days	164	59.8	199	39.2	111	47.7
Totals	277		304		259	
Means of percentages		55.8		53.3		47.1

ally upwards till they are about 30 feet up. The young may sit together on a branch to be fed and to sleep.

Duration of Breeding Season.—The date of laying for 12 nests can be approximated by calculation backwards from known dates of hatching or fledging. Assuming 14 days for incubation and 15 for fledging, the laying dates are: May 24 (2 nests), May 31, June 4, 5, 7, 10, 11, 12, 18, 28, and July 2. It is apparent that in 1956 in this area the peak of laying occurred in the first week of June. Presumably the late nests were reneesting by birds whose first nest or mate had been destroyed.

There was no evidence of a second nesting in this area. No breeding behavior was seen in the territories where a brood had been successfully raised. Furthermore, both male and female care for the young for as much as 20 days after leaving the nest. However, Bent (1940:216) states (without evidence) that two broods are "often, if not regularly" raised in the southern portion of the range.

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SUMMARY

During the summer of 1956, observations of territorial behavior and nesting of the Least Flycatcher (*Empidonax minimus*) were obtained at the University of Virginia Biological Station at Mountain Lake, Virginia. The birds nested in the oak forest and the park-like grounds of the Station. Most of the 14 nests were in oaks, either in a crotch or on a branch. The average height was 16 feet. The clutch size was 3.6 based on five nests with eggs and three nests with young when found. About 80 per cent of the eggs produced fledglings.

The call notes consist of at least eight types. (1) The male position note (*chebec*) is given at a rate of about 700 per 15 minutes, from 0430-0530 at the time of laying. It declines during the day and the rest of the breeding cycle. It increases in frequency during laying and after disappearance of the female. (2) The female has a note (*whit*) that appears to have the same function. (3) The alarm (*tweep*) is given by both sexes. (4) The flight song at dusk is performed by the male. (5) Greetings are given when members of

a pair meet. (6) An aggressive call (*weep-weep*) is used when fighting with other Least Flycatchers. (7) A special note (*churr*) is given as the nest is built. (8) The young have a location note.

Incubation is performed only by the female, who spends about 80 per cent of her time on the nest. Males and females feed the young about equally frequently. The rate of feeding by both birds increased from about six per hour during the first third of the feeding phase to about 15 per hour during the last third.

The territorial behavior resembles that of other members of the genus. The males defend an area but the role of the *chebec* note is not clear. It is given from prominent places within the territory but it is not used when fighting and, in the two cases available, increased in frequency up to the start of incubation. Defense of territory is associated with an aggressive note.

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